

Appl. No. 10/093,928
Amdt. dated 10/17/2005
Reply to the Office Action of 6/14/2005

REMARKS

Reexamination and reconsideration of this application as amended is requested. By this amendment, Claims 16 and 18 have been amended. After this amendment, Claims 1-19 remain pending in this application.

Claim Rejections - 35 USC § 112

(1-3) Applicants thank the Examiner for the recommended correction of the claim language in independent Claims 16 and 18, respectively. Accordingly, Applicants have amended these claims to delete the word "not" which now renders these claims clear and definite and logically correct, as per the teachings of the present invention. The amendment of these claims was not to further limit the claims in view of any prior art or for patentability, and was merely to correct a lexical error obvious from the teachings of the present invention as found in the original specification as filed. No new matter was added. In view of the amendment and remarks above, Applicants kindly request the Examiner withdraw the rejection of the Claims 16-19 under 35 USC § 112, second paragraph.

Claim Rejections - 35 USC § 103

(4-5) The Examiner rejected Claims 1-2, 9, and 16-19, under 35 U.S.C. 103(a) as being unpatentable over Shibata et al., U.S. Patent No. 6,426,892, in view of Norman, U.S. Patent No. 6,438,665.

Applicants have amended independent Claims 16 and 18, to more clearly recite the present invention. These amendments were done only for clarification, and not for patentability or to further limit the claims in view of any prior art. No new matter was added.

Applicants respectfully disagree with the Examiner's opinion expressed in the Office

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Action. Specifically, as will be discussed in detail below, the cited references Shibata and Norman have different purposes and their solutions proposed are different from the presently claimed invention, as recited for independent claims 1, 16, and 18, and for all dependent claims depending therefrom, respectively,

First of all, the Examiner cited Shibata and asserted that it discloses a method of programming an electrically programmable memory that can be read in claim 1 of the present patent application. Applicants respectfully disagree with this characterization of Shibata.

Shibata relates to a four-level NAND EPROM having double page architecture, wherein the two pages are addressable in reading or writing independently from one another. In particular, Gray coding is adopted in Shibata for defining a correspondence between the possible values of the two-bit code word in a generic cell, and the threshold voltage values thereof. Due to Gray coding, when the second page has to be programmed (see FIG. 13B of Shibata) the content of the corresponding first page needs to be preliminary read (block ST12), and the read data combined with the data to be programmed as received from outside (block ST11).

As depicted in FIG. 1 of Shibata, programming the second page to a "0" means causing a cell in state "0" (lowest threshold voltage) to be brought into state "3" (highest threshold voltage) or causing a cell in state "1" to be brought into state "2".

Shibata shows in FIG. 13B the procedure for a two-step verify access (blocks ST14 and ST15) to ascertain the reaching of the two different programming states "2" and "3" by the memory cells initially in state "1" and "0", respectively. As soon as a generic memory cell reaches the target programming state, such as reaching state "3" for a cell initially in state "0" and reaching state "2" for a cell initially in state "1", **it is no more subjected to programming pulses**, and the programming goes on to the remaining cells. The programming operation ends when the last memory cell passes the verify.

The two verify steps in Shibata are nothing more than what, in the instant application, is

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called the verify step 407 illustrated in FIG. 4A.

However, as discussed in the present application, problems may arise during the memory operation because a generic memory cell may be verified as properly programmed in a verify step at biasing conditions that are quite different from those experienced in the normal operation; due to the fact that the biasing conditions at which the memory cell is verified as correctly programmed actually strongly depend on the programming state of the remaining cells. That is, if there is a high number of cells that still have to reach the desired programming state, an overall current sunk during the verify of the cell under consideration is much higher than the overall current sunk in normal operation when such cell is accessed.

Thus, according to the presently claimed invention, the method includes a final step of re-ascertaining of the programming state of the memory cells being programmed. The final step is performed after a predetermined number of memory cells have been verified as programmed (so that the biasing conditions are closer to the real ones experienced in normal operations), and being performed on the memory cells that were previously already verified. If one or more cells is not re-ascertained as properly programmed, then new programming pulses are applied.

Shibata does not teach or suggest the problem tackled and solved by the presently claimed invention. In particular, the Examiner's comparison of the method described in Shibata and the presently claimed one neglected to consider that in Shibata the first and second verify steps ST14 and ST15 are performed on those memory cells that are not yet verified as programmed to the target programming state. In Shibata, when a cell reaches a programming state it is considered verified and is no more subjected to programming pulses and verify operations.

On the contrary, the presently claimed method provides for re-submitting to verify those cells that have already been verified as programmed, but at a later stage of the programming operation, so as to ascertain whether those cells are verified even in the changed biasing conditions. If not, the memory cells are applied one or more additional programming pulses.

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This is significantly different than the teachings of Shibata.

While the Examiner appears to regard the claim language "after the programming state of a prescribed number of memory cells in the group has been ascertained" appearing in claim 1 as readable on Shibata, this is not true. In fact, the second verify read (block ST15) in Shibata is performed during the normal iteration of applying programming pulses and verifying if the memory cells are properly programmed, simply for verifying the reaching of the state "3" by those cells initially in state "0". On the other hand, in the presently claimed method, the memory cells that have already been ascertained are accessed again essentially at the end of the programming operation (possibly at least after a prescribed number of memory cells have been ascertained as properly programmed), so as to re-ascertain that they continue to be properly programmed (so as to get a confirmation of the fact that these cells are programmed to the target state). This is a significant difference in the presently claimed invention from the Shibata teachings.

Norman has just been relied upon in the Office Action for the feature of preliminary accessing a group of memory cells to ascertain their programming state before starting to apply the programming pulses. Norman, however, is silent on the remaining features of the presently claimed invention.

Accordingly, in view of the amendments and remarks above, since Shibata, Norman, or any combination thereof, do not teach, anticipate, or suggest, the presently claimed invention as recited for independent Claims 1, 16, and 18, and for all of the dependent claims that depend therefrom, respectfully, Applicants believe that the rejection of Claims 1-2, 9, and 16-19, under 35 U.S.C. 103(a) has been overcome. The Examiner should withdraw the rejection of these claims.

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Allowable Subject Matter

Applicants wish to acknowledge and thank the Examiner for recognizing Claims 3-8 and 10-15 as containing allowable subject matter. In view of the remarks above, Applicants believe that these dependent claims, depending from independent Claim 1, are currently in allowable form. Accordingly, Applicants kindly request that the Examiner allow these claims.

Conclusion

The foregoing is submitted as full and complete response to the Official Action mailed June 14, 2005, and it is submitted that Claims 1-19 are in condition for allowance. Reconsideration of the rejections is requested. Allowance of Claims 1-19 is earnestly solicited.

No amendment made was related to the statutory requirements of patentability unless expressly stated herein. No amendment made was for the purpose of narrowing the scope of any claim, unless Applicant has argued herein that such amendment was made to distinguish over a particular reference or combination of references.

Applicants acknowledge the continuing duty of candor and good faith to disclose information known to be material to the examination of this application. In accordance with 37 CFR § 1.56, all such information is dutifully made of record. The foreseeable equivalents of any territory surrendered by amendment are limited to the territory taught by the information of record. No other territory afforded by the doctrine of equivalents is knowingly surrendered and everything else is unforeseeable at the time of this amendment by the Applicants and the attorneys.

The present application, after entry of this amendment, comprises nineteen (19) claims, including three (3) independent claims. Applicants have previously paid for twenty (20) claims including three (3) independent claims. Applicants, therefore, believe that a fee for claims amendment is currently not due.

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However, a petition for extension of time to file this Response has been attached. The Commissioner is authorized to charge the extension fee of \$450, or if this fee amount is insufficient or incorrect, then the Commissioner is authorized to charge the appropriate fee amount to prevent this application from becoming abandoned to Deposit Account 50-1556.

If the Examiner believes that there are any informalities that can be corrected by Examiner's amendment, or that in any way it would help expedite the prosecution of the patent application, a telephone call to the undersigned at (561) 989-9811 is respectfully solicited.


The Commissioner is hereby authorized to charge any fees that may be required or credit any overpayment to Deposit Account 50-1556.

In view of the preceding discussion, it is submitted that the claims are in condition for allowance. Reconsideration and re-examination is requested.

Respectfully submitted,

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